

CLAIMS

1. A hydraulic pressure control device of a construction machine, comprising:
 - first and second variable displacement hydraulic pumps,
 - first and second hydraulic actuators driven by being supplied with pressure oil discharged from the first and the second variable displacement hydraulic pumps,
 - first and second main operation valves that switch directions and flow rates of the pressure oil supplied to the first and the second hydraulic actuators,
 - first and second discharge fluid passages that connect discharge ports of the first and the second variable displacement hydraulic pumps with the first and the second main operation valves,
 - first and second pressure compensation valves that compensate each differential pressure before and after the first and the second main operation valves to each predetermined value,
 - a first merging/separating valve that switches between a merge position, which makes a connection between the first discharge fluid passage and the second discharge fluid passage, and a separation position, which blocks between the first discharge fluid passage and the second discharge fluid passage,
 - maximum load pressure detection means that detects maximum load pressure among load pressures of the first and the second hydraulic actuators,
 - first and second load pressure introduction fluid passages that introduce load pressure to the first and the second pressure compensation valves,
 - a second merging/separating valve that switches between a merge position, which introduces pressure oil with the maximum load pressure as detected by the maximum load pressure detection means to the first and the second load pressure introduction fluid passages, and a separation position, which introduces the load pressures of the first and the second hydraulic actuators to the corresponding first and second load pressure introduction fluid passages respectively, and

control means that controls a switching of the first and the second merging/separating valves such that, when it is determined that the first merging/separating valve and the second merging/separating valve are to be switched from the merge position to the separation position, an operation of a switching of the first merging/separating valve from the merge position to the separation position is performed initially, and after the switching of the first merging/separating valve has been completed, an operation to switch the second merging/separating valve from the merge position to the separation position is performed.

2. A hydraulic pressure control device of a construction machine, comprising:
 - first and second variable displacement hydraulic pumps,
 - first and second hydraulic actuators driven by being supplied with pressure oil discharged from the first and the second variable displacement hydraulic pumps,
 - first and second main operation valves that switch directions and flow rates of the pressure oil supplied to the first and the second hydraulic actuators,
 - first and second discharge fluid passages that connect discharge ports of the first and the second variable displacement hydraulic pumps with the first and the second main operation valves,
 - first and second pressure compensation valves that compensate each differential pressure before and after the first and the second main operation valves to each predetermined value,
 - a first merging/separating valve that switches between a merge position, which makes a connection between the first discharge fluid passage and the second discharge fluid passage, and a separation position, which blocks between the first discharge fluid passage and the second discharge fluid passage,
 - maximum load pressure detection means that detects maximum load pressure among load pressures of the first and the second hydraulic actuators,

first and second load pressure introduction fluid passages that introduce load pressure to the first and the second pressure compensation valves,

a second merging/separating valve that switches between a merge position, which introduces pressure oil with the maximum load pressure as detected by the maximum load pressure detection means to the first and the second load pressure introduction fluid passages, and a separation position, which introduces the load pressures of the first and the second hydraulic actuators to the corresponding first and second load pressure introduction fluid passages respectively,

necessary flow rate calculation means that calculates necessary flow rates to be supplied to the first and the second hydraulic actuators,

determination means for determining whether each of the necessary flow rates of the first and the second hydraulic actuators calculated by the necessary flow rate calculation means is less than maximum discharge flow rate per pump of the first and the second variable displacement hydraulic pumps, and

control means that controls a switching of the first and the second merging/separating valves such that, when the first merging/separating valve and the second merging/separating valve are in the merge position and the determination means determines that each of the necessary flow rates of the first and the second hydraulic actuators is less than the maximum discharge flow rate per pump of the first and the second variable displacement hydraulic pumps, an operation of a switching of the first merging/separating valve from the merge position to the separation position is performed initially, and after the switching of the first merging/separating valve has been completed, an operation to switch the second merging/separating valve from the merge position to the separation position is performed.

3. A hydraulic pressure control device of a construction machine, comprising:
first and second variable displacement hydraulic pumps,

first and second hydraulic actuators driven by being supplied with pressure oil discharged from the first and the second variable displacement hydraulic pumps,

first and second main operation valves that switch directions and flow rates of the pressure oil supplied to the first and the second hydraulic actuators,

first and second discharge fluid passages that connect discharge ports of the first and the second variable displacement hydraulic pumps with the first and the second main operation valves,

first and second pressure compensation valves that compensate each differential pressure before and after the first and the second main operation valves to each predetermined value,

a first merging/separating valve that switches between a merge position, which makes a connection between the first discharge fluid passage and the second discharge fluid passage, and a separation position, which blocks between the first discharge fluid passage and the second discharge fluid passage,

maximum load pressure detection means that detects maximum load pressure among load pressures of the first and the second hydraulic actuators,

first and second load pressure introduction fluid passages that introduce load pressure to the first and the second pressure compensation valves,

a second merging/separating valve that switches between a merge position, which introduces pressure oil with the maximum load pressure as detected by the maximum load pressure detection means to the first and the second load pressure introduction fluid passages, and a separation position, which introduces the load pressures of the first and the second hydraulic actuators to the corresponding first and second load pressure introduction fluid passages respectively,

necessary flow rate calculation means that calculates necessary flow rates to be supplied to the first and the second hydraulic actuators,

determination means to determine whether each of the necessary flow rates of the first and the second hydraulic actuators calculated by the necessary flow rate

calculation means is less than maximum discharge flow rate per pump of the first and the second variable displacement hydraulic pumps, and

control means that controls a switching of the first merging/separating valve and the second merging/separating valve from the merge position to the separation position, when the first merging/separating valve and the second merging/separating valve are in the merge position and the determination means determines that each of the necessary flow rates of the first and the second hydraulic actuators is less than maximum discharge flow rate per pump of the first and the second variable displacement hydraulic pumps.

4. The hydraulic pressure control device of a construction machine according to Claim 1, wherein the control means controls the switching of the first and the second merging/separating valves such that, when it is determined that the first merging/separating valve and the second merging/separating valve are to be switched from the separation position to the merge position, an operation of a switching of the second merging/separating valve from the separation position to the merge position is performed initially, and after the switching of the second merging/separating valve has been completed, an operation to switch the first merging/separating valve from the separation position to the merge position is performed.

5. The hydraulic pressure control device of a construction machine according to Claim 2, wherein the control means controls the switching of the first and the second merging/separating valves such that, when the first merging/separating valve and the second merging/separating valve are in the separation position and the determination means determines that at least one of the necessary flow rates of the first and the second hydraulic actuators is the maximum discharge flow rate or more per pump of the first and the second variable displacement hydraulic pumps,

an operation of a switching of the second merging/separating valve from the separation position to the merge position is performed initially, and after the switching of the second merging/separating valve has been completed, an operation to switch the first merging/separating valve from the separation position to the merge position is performed.

6. The hydraulic pressure control device of a construction machine according to Claim 3, wherein the control means performs control to switch the first merging/separating valve and the second merging/separating valve from the separation position to the merge position, when the first merging/separating valve and the second merging/separating valve are in the separation position and the determination means determines that at least one of the necessary flow rates of the first and the second hydraulic actuators is the maximum discharge flow rate or more per pump of the first and the second variable displacement hydraulic pumps.

7. A hydraulic pressure control device of a construction machine, comprising:
first and second variable displacement hydraulic pumps,
first and second hydraulic actuators driven by being supplied with pressure oil discharged from the first and the second variable displacement hydraulic pumps,
first and second main operation valves that switch directions and flow rates of the pressure oil supplied to the first and the second hydraulic actuators,
first and second discharge fluid passages that connect discharge ports of the first and the second variable displacement hydraulic pumps with the first and the second main operation valves,
first and second pressure compensation valves that compensate each differential pressure before and after the first and the second main operation valves to each predetermined value,

a first merging/separating valve that switches between a merge position, which makes a connection between the first discharge fluid passage and the second discharge fluid passage, and a separation position, which blocks between the first discharge fluid passage and the second discharge fluid passage,

maximum load pressure detection means that detects maximum load pressure among load pressures of the first and the second hydraulic actuators,

first and second load pressure introduction fluid passages that introduce load pressure to the first and the second pressure compensation valves,

a second merging/separating valve that switches between a merge position, which introduces pressure oil with the maximum load pressure as detected by the maximum load pressure detection means to the first and the second load pressure introduction fluid passages, and a separation position, which introduces the load pressures of the first and the second hydraulic actuators to the corresponding first and second load pressure introduction fluid passages respectively, and

control means that controls a switching of the first and the second merging/separating valves such that, when it is determined that the first merging/separating valve and the second merging/separating valve are to be switched from the separation position to the merge position, an operation of a switching of the second merging/separating valve from the separation position to the merge position is performed initially, and after the switching of the second merging/separating valve has been completed, an operation to switch the first merging/separating valve from the separation position to the merge position is performed.

8. A hydraulic pressure control device of a construction machine, comprising:
 - first and second variable displacement hydraulic pumps,
 - first and second hydraulic actuators driven by being supplied with pressure oil discharged from the first and the second variable displacement hydraulic pumps,

first and second main operation valves that switch directions and flow rates of the pressure oil supplied to the first and the second hydraulic actuators,

first and second discharge fluid passages that connect discharge ports of the first and the second variable displacement hydraulic pumps with the first and the second main operation valves,

first and second pressure compensation valves that compensate each differential pressure before and after the first and the second main operation valves to each predetermined value,

a first merging/separating valve that switches between a merge position, which makes a connection between the first discharge fluid passage and the second discharge fluid passage, and a separation position, which blocks between the first discharge fluid passage and the second discharge fluid passage,

maximum load pressure detection means that detects maximum load pressure among load pressures of the first and the second hydraulic actuators,

first and second load pressure introduction fluid passages that introduce load pressure to the first and the second pressure compensation valves,

a second merging/separating valve that switches between a merge position, which introduces pressure oil with the maximum load pressure as detected by the maximum load pressure detection means to the first and the second load pressure introduction fluid passages, and a separation position, which introduces the load pressures of the first and the second hydraulic actuators to the corresponding first and second load pressure introduction fluid passages respectively,

necessary flow rate calculation means that calculates necessary flow rates to be supplied to the first and the second hydraulic actuators,

determination means for determining whether each of the necessary flow rates of the first and the second hydraulic actuators calculated by the necessary flow rate calculation means is less than maximum discharge flow rate per pump of the first and the second variable displacement hydraulic pumps, and

control means that controls a switching of the first and the second merging/separating valves such that, when the first merging/separating valve and the second merging/separating valve are in the separation position and the determination means determines that at least one of the necessary flow rates of the first and the second hydraulic actuators is the maximum discharge flow rate or more per pump of the first and the second variable displacement hydraulic pumps, an operation of a switching of the second merging/separating valve from the separation position to the merge position is performed initially, and after the switching of the second merging/separating valve has been completed, an operation to switch the first merging/separating valve from the separation position to the merge position is performed.

9. A hydraulic pressure control device of a construction machine, comprising:
 - first and second variable displacement hydraulic pumps,
 - first and second hydraulic actuators driven by being supplied with pressure oil discharged from the first and the second variable displacement hydraulic pumps,
 - first and second main operation valves that switch directions and flow rates of the pressure oil supplied to the first and the second hydraulic actuators,
 - first and second discharge fluid passages that connect discharge ports of the first and the second variable displacement hydraulic pumps with the first and the second main operation valves,
 - first and second pressure compensation valves that compensate each differential pressure before and after the first and the second main operation valves to each predetermined value,
 - a first merging/separating valve that switches between a merge position, which makes a connection between the first discharge fluid passage and the second discharge fluid passage, and a separation position, which blocks between the first discharge fluid passage and the second discharge fluid passage,

maximum load pressure detection means that detects maximum load pressure among load pressures of the first and the second hydraulic actuators,

first and second load pressure introduction fluid passages that introduce load pressure to the first and the second pressure compensation valves,

a second merging/separating valve that switches between a merge position, which introduces pressure oil with the maximum load pressure as detected by the maximum load pressure detection means to the first and the second load pressure introduction fluid passages, and a separation position, which introduces the load pressures of the first and the second hydraulic actuators to the corresponding first and second load pressure introduction fluid passages respectively,

necessary flow rate calculation means that calculates necessary flow rates to be supplied to the first and the second hydraulic actuators,

determination means to determine whether each of the necessary flow rates of the first and the second hydraulic actuators calculated by the necessary flow rate calculation means is less than maximum discharge flow rate per pump of the first and the second variable displacement hydraulic pumps, and

control means that controls a switching of the first merging/separating valve and the second merging/separating valve from the separation position to the merge position, when the first merging/separating valve and the second merging/separating valve are in the separation position and the determination means determines that at least one of the necessary flow rates of the first and the second hydraulic actuators is the maximum discharge flow rate or more per pump of the first and the second variable displacement hydraulic pumps.